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10/621,999	07/17/2003	Yousheng Shen	011361.00064	2626

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EXAMINER	
OLSEN, KAJ K	
ART UNIT	**PAPER NUMBER**
1795	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/621,999	SHEN ET AL.	
	Examiner	Art Unit	
	KAJ K. OLSEN	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-94* is/are pending in the application.

4a) Of the above claim(s) *1,3-16 and 75* is/are withdrawn from consideration.

5)☒ Claim(s) *30-74 and 76-78* is/are allowed.

6)☒ Claim(s) *79-94* is/are rejected.

7)☒ Claim(s) *2 and 17-29* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/13/04;10/14/04*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Reissue Applications

1. This reissue application had been filed co-pending with a reexamination application (90/006,208) that has since been concluded (see the reexamination certificate USP 5,573,648 C1 dated January 1, 2008). Current office policy concerning reissue applications where the co-pending reexamination has concluded is to treat any claim that had been cancelled by a reexamination certificate as if it had been cancelled in the reissue application. Because claims 1, 3-16 and 75 were cancelled by reexamination certificate USP 5,573,648 C1, the examiner will withdraw claims 1, 3-16 and 75 from further consideration and treat claims 1, 3-16 and 75 as if they were cancelled. The rejection of claim 1, 3-16 and 75 was affirmed in the BPAI decision of 5/23/07 in reexamination application 90/006, 208. It is suggested that applicant cancel these claims in their next response.

2. Claims 79-94 are rejected under 35 U.S.C. 251 as being broadened in a reissue application filed outside the two year statutory period. In each of claims 79-82, 86-89, and 92, the preamble of the claims has been broadened from "for quantitative measurement" in the originally filed claims to "for measurement." This is a broadening of the scope of the claims. In each of claims 86-89, and 92, the limitation beginning "whereby...", the limitation "means detects changes" has been broadened to "means is capable of detecting changes." In each of claims 86-89 and 92, the limitation "the sensing electrode reacting" has been broadened to "the sensing electrode being capable of reacting." A claim is broader in scope than the original claims if it contains within its scope any conceivable product or process which would not have

infringed the original patent. A claim is broadened if it is broader <u>in any one respect</u> even though it may be narrower in other respects.

3. Claims 79-94 are rejected under 35 U.S.C. 251 as being improperly broadened in a reissue application made and sworn to by the assignee and not the patentee. A claim is broader in scope than the original claims if it contains within its scope any conceivable product or process which would have infringed the original patent. A claim is broadened if it is broader <u>in any one respect</u> even though it may be narrower in other respects. See the discussion above for the instances of broadening in new claims 79-94.

Oath/Declaration

4. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

> The oath or declaration is defective because: It states that additional inventors are named on a separately numbered sheet, but the Office records show no additional sheet attached.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 79, 81, 86, and 88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dempsey et al (USP 4,227,984) in view of Nagata et al (USP 4,913,792) and any of Vanderborgh et al (USP 4,804,592), Uchida et al (USP 5,474,857) and/or Grot et al (USP 5,330,860). Nagata is being cited and relied on for the first time with this office action.

8. With respect to claim 79, Dempsey discloses an electrochemical gas sensor that comprises a sensing electrode 13, a counter electrode 10, with a protonic conductive electrolyte membrane 9 between and in contact with both the sensing and counter electrodes (fig. 2). Dempsey teaches the use of a membrane with a thickness that reads on the claimed thickness (col. 11, lines 58-60). The sensing electrode reacts with the gas to be measured and the sensor has a means for electrical measurement (fig. 3). With respect to the area of the electrodes, see col. 11, lines 65-67. 1.6 cm would read on "approximately…15 mm" giving the claim language its broadest reasonable interpretation. Dempsey does not explicitly teach the use of sensing and counter electrodes that contain both ionically and electrically conductive materials. Dempsey does recognize that the electrodes set forth in the fuel cell prior art find utility for the sensor of Dempsey (col. 8, lines 30-63). In the fuel cell art, it is common to utilize a combination of ionically and electrically conductive material for the electrodes for fuel cells. In particular,

Vanderborgh and Grot teach the use of a combination of said materials and teaches that said combination of materials provides a fuel cell with improved efficiency and internal resistance (col. 2, lines 42 and 43 of Vanderborgh and col. 4, lines 26-29 of Grot). Uchida teaches a particular electrode for use in fuel cells that is a combination of proton conducting material and electrically conducting material. Grot also teaches the use of fuel cell electrodes having both ionically and electrically conductive materials that also satisfy the claimed compositions (col. 4, line 35 through col. 5, line 2; and col. 14, lines 15-27). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teachings of any of Vanderborgh, Uchida, and/or Grot for the sensor of Dempsey because these electrodes have shown previous favorable utility in the fuel cell art, and the substitution of one known fuel cell electrode composition for another, when the results are not unexpected, requires only routine skill in the art. Furthermore, the addition of ionically conductive material to the electrode would improve the effective resistance of the electrodes as well as facilitate the removal of the solid-solid interfaces between the electrodes and the membrane (Vanderborgh, col. 2, lines 25-43). Although the secondary references are drawn principally towards fuel cell power sources, Uchida and Grot both recognized the utility of their teachings to fuel cell based sensors like those of Dempsey (see Uchida, col. 10, lines 60-64; and Grot, col. 1, lines 19-30). In addition, Dempsey recognized the utility of the teachings from the general fuel cell art for the disclosed sensor (col. 8, lines 30-63).

9. Dempsey also did not teach that the sensing and counter electrodes are the only two electrodes in contact with the first protonic conductive electrolyte membrane. Rather Dempsey taught the addition of a third reference electrode 32 that is also in contact with the membrane.

However, Nagata teaches that it is not necessary to utilize a reference electrode to stabilize the potential of the working electrode as long as the counter electrode is large enough to help maintain a stable potential at the working electrode. Nagata also teaches that such a two-electrode cell simplifies the circuitry as it obviates the need for a potentiostat to control the potential of the working electrode. Compare fig. 1 with fig. 8 and see col. 7, l. 66 - col. 8, l. 11. Because Nagata teaches that both two and three electrode gas sensors were known in the art and that sensors were readily transferable between the two, and further taught that two-electrode sensors have simplified circuitry, it would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize only two-electrodes for the sensor of Dempsey in view of Vanderborgh, Uchida, and/or Grot as taught by Nagata because the substitution of one known sensor structure (two-electrode) for another known structure (three-electrode) requires only routine skill in the art. In addition, the use of a two-electrode configuration has the added advantage of being simpler to construct and operate.

10. With respect to claim 81 (those limitations not covered above), because the electrode of Dempsey in view of Vanderborgh, Uchida, and/or Grot already rendered obvious the combination of catalytic electronic conducting material (e.g. Pt) and ion conducting material (e.g. Nafion) for the electrodes with overlapping composition to the electrodes of the instant invention, then such an electrode would inherently be capable of reacting with a gas in the absence of an applied voltage to the sensing electrode. The fact that Dempsey operates its sensor using an applied voltage to the sensing electrode does not read free of this limitation because whether or not a voltage is applied is how the sensor is to be utilized and does not further define the structure of the device.

11. With respect to claims 86 and 88 (those limitations not covered above), whether or not the sensor is operated at room temperature is only the intended use of the apparatus and the intended use need not be given further due consideration in determining patentability. It is noted however that the sensor of Dempsey can be utilized at room temperature as evidenced by col. 2, ll. 30-35.

12. Claims 79-94 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomantschger et al (USP 5,173,166) in view of Dempsey and any or Vanderborgh, Uchida, and/or Grot.

13. With respect to claim 79, Tomantschger discloses a two-electrode electrochemical gas sensor for measuring a gas in an ambient atmosphere (col. 5, ll. 27-32) comprising a porous sensing electrode 12 containing electronically conducting material, a porous counter electrode 16 also containing electronically conducting material (col. 8, ll. 13-20 and examples 1-5 of col. 12), and a first protonic conductive electrolyte membrane 24 (col. 6, ll. 61-63) in between and in contact with the sensing and counter electrodes where the sensing and counter electrodes are the only two electrodes in contact with the membrane (fig. 3 for example). Tomantschger discloses that the sensing electrode reacts with the gas to produce a change in electrical characteristic (either a potential or a current) between the sensing electrode and counter electrode (col. 7, ll. 21-33), whereby in a positive ambient concentration of said gas, said electrical measurement detects changes in said electrical characteristics (fig. 6 and 7). Tomantschger does not explicitly disclose the addition of an ionically conducting material to the electrodes of the sensor. However, it is noted that Tomantschger admits that its sensor is essentially functioning as a fuel cell device. See col. 8, ll. 23-28. In the fuel cell art, it is common to utilize a combination of

ionically and electrically conductive material for the electrodes for fuel cells. In particular, Vanderborgh and Grot teach the use of a combination of said materials and teaches that said combination of materials provides a fuel cell with improved efficiency and internal resistance (col. 2, lines 42 and 43 of Vanderborgh and col. 4, lines 26-29 of Grot). Uchida teaches a particular electrode for use in fuel cells that is a combination of proton conducting material and electrically conducting material. Grot also teaches the use of fuel cell electrodes having both ionically and electrically conductive materials that also satisfy the claimed compositions (col. 4, line 35 through col. 5, line 2; and col. 14, lines 15-27). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teachings of any of Vanderborgh, Uchida, and/or Grot for the electrodes of Tomantschger for the sensor of Tomantschger because these electrodes have shown previous favorable utility in the fuel cell art, and the substitution of one known fuel cell electrode composition for another, when the results are not unexpected, requires only routine skill in the art. Furthermore, the addition of ionically conductive material to the electrode of Tomantschger would improve the effective resistance of the electrodes as well as facilitate the removal of the solid-solid interfaces between the electrodes and the membrane (Vanderborgh, col. 2, lines 25-43). Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was being made to add ionically conducting material to the electronically conducting electrodes of Tomanstschger in order to increase the electrode efficiency and reduce its resistance. Uchida and Grot both recognized the utility of their teachings to fuel cell based sensors like those of Tomantschger (see Uchida, col. 10, lines 60-64; and Grot, col. 1, lines 19-30).

14. Tomantschger also did not explicitly disclose either a particular diameter for its electrodes or a particular thickness of protonic conductive electrolyte membrane. However, the previously relied on Dempsey taught for a different CO sensor that electrodes having a diameter of 16 mm with a Nafion membrane having a thickness overlapping the claimed range provided suitable dimensions for the electrodes and membrane. See col. 11, ll. 58-68. The examiner takes the position that 16 mm either reads on "approximately 1 mm to 15 mm" or is so close to 1-15 mm as to not constitute a patentable distinction. This position was affirmed in the appeal decision for Reexamination 90/006,208 dated 5/23/2007. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the electrode and electrolyte dimensions from Dempsey for the electrodes and electrolyte of Tomantschger because these dimensions have been previously shown to provide effective CO sensitivity. Because Tomantschger did not explicitly disclose any dimensions of electrode diameter or electrolyte thickness, this would lead one possessing ordinary skill in the art to conclude that electrode area and membrane thickness were not critical to the sensor of Tomantschger and would have though to utilize dimensions disclosed from previous successful CO monitors for the construction of the sensor disclosed by Tomantschger. The teaching of Dempsey was already identified by Tomantschger as being an effective prior art sensor. See Tomantschger, col. 3, ll. 15-20.

15. With respect to claim 80 (those limitations not covered above), the sensing electrode of Tomantschger produces an electrical change in the absence of any applied voltage. See col. 7, ll. 26-33.

16. With respect to claim 81, see the discussion of claims 79 and 80 above.

17. With respect to claims 82-85 (those limitations not covered above), the sensing and counter electrodes are on opposite sides of the protonic conductive electrolyte membrane (see fig. 3).

18. With respect to claims 86-91 (those limitations not discussed above), Tomantschger operates its sensor at room temperature. See col. 5, ll. 27-32.

19. With respect to claims 92-94 (those limitations not covered above), Tomantschger is a non-biased device as they apply no biasing potential to the electrodes.

20. Claims 80, 82, 84, 87, 89, 91, 92, and 94 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dempsey in view of any of Vanderborgh, Uchida and/or Grot.

21. With respect to claim 80, Dempsey discloses an electrochemical gas sensor that comprises a sensing electrode 13, a counter electrode 10, with a protonic conductive electrolyte membrane 9 between and in contact with both the sensing and counter electrodes (fig. 2). Dempsey teaches the use of a membrane with a thickness that reads on the claimed thickness (col. 11, lines 58-60). The sensing electrode reacts with the gas to be measured and the sensor has a means for electrical measurement (fig. 3). With respect to the area of the electrodes, see col. 11, lines 65-67. 1.6 cm would read on "approximately...15 mm" giving the claim language its broadest reasonable interpretation. Dempsey does not explicitly teach the use of sensing and counter electrodes that contain both ionically and electrically conductive materials. Dempsey does recognize that the electrodes set forth in the fuel cell prior art find utility for the sensor of Dempsey (col. 8, lines 30-63). In the fuel cell art, it is common to utilize a combination of ionically and electrically conductive material for the electrodes for fuel cells. In particular, Vanderborgh and Grot teach the use of a combination of said materials and teaches that said

combination of materials provides a fuel cell with improved efficiency and internal resistance (col. 2, lines 42 and 43 of Vanderborgh and col. 4, lines 26-29 of Grot). Uchida teaches a particular electrode for use in fuel cells that is a combination of proton conducting material and electrically conducting material. Grot also teaches the use of fuel cell electrodes having both ionically and electrically conductive materials that also satisfy the claimed compositions (col. 4, line 35 through col. 5, line 2; and col. 14, lines 15-27). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teachings of any of Vanderborgh, Uchida, and/or Grot for the sensor of Dempsey because these electrodes have shown previous favorable utility in the fuel cell art, and the substitution of one known fuel cell electrode composition for another, when the results are not unexpected, requires only routine skill in the art. Furthermore, the addition of ionically conductive material to the electrode would improve the effective resistance of the electrodes as well as facilitate the removal of the solid-solid interfaces between the electrodes and the membrane (Vanderborgh, col. 2, lines 25-43). Although the secondary references are drawn principally towards fuel cell power sources, Uchida and Grot both recognized the utility of their teachings to fuel cell based sensors like those of Dempsey (see Uchida, col. 10, lines 60-64; and Grot, col. 1, lines 19-30). In addition, Dempsey recognized the utility of the teachings from the general fuel cell art for the disclosed sensor (col. 8, lines 30-63). With respect to the limitation concerning the sensing electrode reacting with the gas in the absence of an applied voltage, because the electrode of Dempsey in view of Vanderborgh, Uchida, and/or Grot already rendered obvious the combination of catalytic electronic conducting material (e.g. Pt) and ion conducting material (e.g. Nafion) for the electrodes with overlapping composition to the electrodes of the instant invention, then such an

electrode would inherently be capable of reacting with a gas in the absence of an applied voltage to the sensing electrode. The fact that Dempsey operates its sensor using an applied voltage to the sensing electrode does not read free of this limitation because whether or not a voltage is applied is how the sensor is to be utilized and does not further define the structure of the device.

22. With respect to claims 82 and 84 (those limitations not covered above), the sensing and counter electrodes (31, 33) of Dempsey are on opposite sides of the protonic conductive membrane. See fig. 3.

23. With respect to claims 87, 89, and 91 (those limitations not covered above) whether or not the sensor is operated at room temperature is only the intended use of the apparatus and the intended use need not be given further due consideration in determining patentability. It is noted however that the sensor of Dempsey can be utilized at room temperature as evidenced by col. 2, ll. 30-35.

24. With respect to claims 92 and 94 (those limitations not covered above), specifying that the sensor is non-biased in the preamble does not further define the structure of the sensor and merely constitutes the intended use of the structure. Alternatively, the sensor of Dempsey would be non-biased when the potentiostat connected to the electrodes is either disconnected or turned off.

25. Claims 83, 85, 90, and 93 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dempsey in view of any or Vanderborgh, Uchida, and/or Grot as applied to claims 82, 89, and 93 above, and further in view of Nagata.

26. With respect to claims 83, 90, and 93, the references set forth all the limitations of the claims, but did not specify that the sensing electrode and the counter electrode are the only two

electrodes in contact with the electrolyte membrane. Rather Dempsey taught the addition of a third reference electrode 32 that is also in contact with the membrane. However, Nagata teaches that it is not necessary to utilize a reference electrode to stabilize the potential of the working electrode as long as the counter electrode is large enough to help maintain a stable potential at the working electrode. Nagata also teaches that such a two-electrode cell simplifies the circuitry as it obviates the need for a potentiostat to control the potential of the working electrode. Compare fig. 1 with fig. 8 and see col. 7, l. 66 - col. 8, l. 11. Because Nagata teaches that both two and three electrode gas sensors were known in the art and that sensors were readily transferable between the two, and further taught that two-electrode sensors have simplified circuitry, it would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize only two-electrodes for the sensor of Dempsey in view of Vanderborgh, Uchida, and/or Grot as taught by Nagata because the substitution of one known sensor structure (two-electrode) for another known structure (three-electrode) requires only routine skill in the art. In addition, the use of a two-electrode configuration has the added advantage of being simpler to construct and operate.

27. With respect to claim 85, because the electrode of Dempsey in view of Vanderborgh, Uchida, and/or Grot already rendered obvious the combination of catalytic electronic conducting material (e.g. Pt) and ion conducting material (e.g. Nafion) for the electrodes with overlapping composition to the electrodes of the instant invention, then such an electrode would inherently be capable of reacting with a gas in the absence of an applied voltage to the sensing electrode. The fact that Dempsey operates its sensor using an applied voltage to the sensing electrode does not

read free of this limitation because whether or not a voltage is applied is how the sensor is to be utilized and does not further define the structure of the device.

Allowable Subject Matter

28. Claims 2 and 17-29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

29. Claims 30-74 and 76-78 are allowed.

30. The following is a statement of reasons for the indication of allowable subject matter: With respect to claims 2 and 30, the prior art does not disclose nor render obvious all the cumulative limitations of these claims with particular attention to the specified switch means for alternating electrical connection between the sensing and counter electrodes. With respect to claim 17, the prior art does not disclose all the cumulative limitations of the claims with particular attention to the use of carbon black for one of the electrical conductor materials with Ru oxide for the other electrical conductor materials. With respect to claims 18, 27, and 47, the prior art does not disclose nor render obvious all the cumulative limitations of these claims with particular attention to the presence of the first and second pump electrodes. With respect to claim 59, the prior art does not disclose nor render obvious all the cumulative limitations of the claim with particular attention to the means for applying DC power whereby the gas is transported away from the reference electrode. With respect to claims 19-26, 28, 29, 31-46, 48-58, 60-74, and 76-78, these claims depend from the above otherwise allowable claims and are thereby also allowable.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KAJ K. OLSEN whose telephone number is (571)272-1344. The examiner can normally be reached on M-F 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kaj K Olsen/
Primary Examiner, Art Unit 1795
March 18, 2008